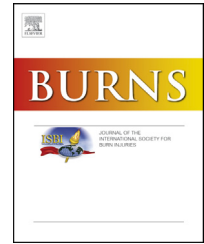


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Epidemiological and bacteriological profiles in children with burns



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ABSTRACT

Objectives: The aim of our study is to determine the most prevalent bacteria responsible for nosocomial infection (NI) in burned children.

Materials and methods: A prospective analytic study was conducted over a period of 30 months at the Children's Hospital of Tunisia. All burned children were enrolled.

Results: A total of 185 children were hospitalised during the study period. The mean age was 30 months (interquartile range, IR:18; 48). The gender ratio of the study population was 1.3 (104 males and 81 females). The mean total body surface area burned (TBSA) was 10% (IR:6; 16). The incidence rate of NI was 39.1 NIs per 1000 patient-days and two-thirds of the infections were polymicrobial. The most common isolated micro-organisms were methicillin-susceptible *Staphylococcus aureus* (MSSA, 57.7%), wild-type *Pseudomonas aeruginosa* (35.9%) and wild-type *Enterobacter cloacae* (26.9%). The case fatality rate was 5.9% corresponding to a crude death rate of 1.32 deaths per year. Septic shock with multiple organ failure was the leading cause of death.

Conclusion: The most common micro-organisms responsible for NI in our series were of the wild-type phenotype. Thus, on suspicion of sepsis, empiric antibiotic treatment combining piperacillin, oxacillin and gentamicin can be proposed until identification of the causative microorganism is available.

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1. Introduction

Infectious complications are one of the most important and potentially serious complications that occur in the acute period following burn [1,2]. They are an important contributor to morbidity and mortality in patients with burns, mainly in children [3–8].

An analysis of the common isolates from the burn wounds and blood cultures and their sensitivity patterns may help to formulate an institutional drug policy for the burned children [9,10], which may decrease morbidity and mortality.

The aim of our study is to determine the most prevalent bacteria responsible for nosocomial infection (NI) recovered

from burned children in our institution and to describe their sensitivity patterns.

2. Materials and methods

A prospective analytic study was conducted at the Children's Hospital of Tunisia over a period of 30 months after obtaining local ethics committee approval. We enrolled all paediatric burns. The data collected included demographic information (age, gender and body weight) and referral to other medical centres prior to care in our burn units. Burn-related data included mechanism (scalds or other causes), total burn surface area (TBSA) and location and depth of burn

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(partial- or full-thickness), according to clinical criteria. We also noted the rate of invasive device use (central venous catheter (CVC), bladder catheter (BC) and mechanical ventilation (MV)). We have used the American Burn Association (ABA) criteria to define serious burn in children [11]. The extent of the burn surface was estimated using the Lund and Browder chart [12].

Paediatric burns were isolated and hospitalised in private rooms in the surgical ward with a maximum two children per room. The dressing procedure of burns in the body included wound cleaning by using normal saline with eventual excision and escharotomy followed by an occlusive dressing with povidone-iodine-soaked gauze and then by sterile bandage, Velpeau®. Facial burns were treated by application of silver sulphadiazine (Flammazine®) and they were not covered. The dressings were changed every 48 h. Swabs were taken from the burn wounds at the time of admission of new injury for children referred from other medical facilities. At the onset of sepsis signs (clinical or biological signs), immediate investigations were done including: swabs at dressing change especially in areas where there were changes in burn wound appearance, blood culture (obtained from a peripheral venous or from an intravascular catheter), urine culture if there was an indwelling urinary catheter and endotracheal aspirates if the child was mechanically ventilated.

NI was defined as signs and symptoms of infection appearing after at least 48 h following admission to the surgical unit. It was grouped into four main classes: burn wound infections (BWIs), bloodstream infections (BSIs), urinary tract infections (UTIs) and pneumonias. Diagnosis was as defined by the Centers for Disease Control and Prevention (CDC), Atlanta, USA [13], except for BWIs. They were classified according to the criteria developed by Weber et al. [14], which distinguish two types of infection: invasive burn wound infection (IBWI) and non-invasive burn wound infection (NIBWI).

Identification and susceptibility testing of bacterial isolates were performed by standard techniques and the Kirby-Bauer disc diffusion technique, respectively. Antibiotic therapy was subsequently adapted to the antibiogram of isolated bacteria and its duration was decided on according to the type of documented infection with a minimum duration of antibiotic treatment of 5 days. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Version 15.0, SPSS Inc., Chicago, IL, USA) software. Gaussian distribution of quantitative variables was assessed by the normality test of Kolmogorov and Smirnov. Quantitative variables of normal distribution were expressed as mean $\pm$ standard error of the mean (SEM). Quantitative variables of a non-Gaussian distribution were expressed as median with interquartile range (IR). Qualitative variables were expressed as percentages. The incidence rate of NI was calculated as the number of NIs per 1000 patient days. The rate of use of invasive devices was expressed as number of device-days per 1000 patient-days. The analysis of variance (ANOVA) test was used to compare several means and the chi-squared test or Fisher's exact test was used to compare several proportions. Dunnet's T3 procedure was used for post hoc multiple comparisons. $P < 0.05$ was accepted as statistically significant.

3. Results

A total of 185 paediatric burns were hospitalised in the Children's Hospital of Tunisia during the study period of 30 months. Their age ranged from 3 to 12 years with a mean age of 30 months (IR:18; 48). More than 79% of the children were under 5 years of age with peak frequency between 18 months and 3 years. The sex ratio of the study population was 1.3 (104 males and 81 females). The majority of children with burns were admitted during the first 24 h and more than a half (61%) were referred by other medical centres prior to care in our surgical unit. Scald was the most common cause of burn accounting for 76.7% of admissions whereas 16% of the children sustained thermal injuries. Explosion and electrification were extremely rare (2.7% and 1.6%, respectively). The mean burned body surface area (BBSA) was 10% of the total surface area (IR:6; 16) (extremes: 1.5% and 90%). More than half of the children had a TBSA $< 10\%$ and 15.3% of them presented lesions that extended more than 20% of the total surface area. With regard to burn depth, we found that 24 children (13.2%) had third-degree burns and 82 children (44.3%) had serious burns according to the ABA criteria. All children had mixed degrees of burns.

A total of 48 children (25.9%) had a BC, 14 children (7.6%) had a CVC and five children (2.7%) were intubated and mechanically ventilated. In fact, rates of use of invasive devices in our study were 114.3 BC-days, 57.7 CVC-days and 11.2 MV-days per 1000 patient-days.

Among our study population, 22 children had a very short stay (< 3 days); hence, bacteriological samples were not performed. As many as 206 bacteriological samples were positive, isolating 330 bacteria. The proportion of swabs was 83.5%, followed by blood cultures at 14.1%.

Swabs isolated 88.5% of whole bacteria and they were polymicrobial in 56.4% of cases. Blood cultures isolated 9.7% of bacteria and they were monomicrobial in 89.7% of cases. Endotracheal aspirates were monomicrobial in 75% of cases. The culture of the central catheter was positive in one case. None of the urine cultures were positive. The samples never isolated fungi.

Staphylococcus aureus (*S. aureus*) was the most common isolated bacteria accounting for 30.4% of all bacterial cultures performed followed by *Pseudomonas aeruginosa* (*P. aeruginosa*; 23.8%) and *Enterobacter cloacae* (*E. cloacae*; 16%). The other most prevalent organisms recovered were *Klebsiella pneumoniae* (*K. pneumoniae*) at 6.6%, coagulase-negative staphylococci (CNS) at 5.3% and *Escherichia coli* (*E. coli*) at 4.4%. These isolates represent 86.5% of all isolated bacteria. When we analysed the sensitivity patterns of our isolates, we found that the majority of strains were of the wild-type phenotype. Indeed, 93.8% of isolated *S. aureus* were susceptible to methicilline, *P. aeruginosa* was wild-type phenotype in 88.2% of the cases, all *E. cloacae* were wild-type strains and *E. coli* were of the wild-type phenotype in 64.3% of cases. However, *K. pneumoniae* was extended-spectrum- β -lactamase (ESBL)-producing in 66.7% of cases.

As many as 75 children among 163 (46%) developed 84 infectious episodes. There were six episodes of community infections: five NIBWIs and one episode of primary bacteraemia. The responsible germs were primarily of the

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